

## CLAIMS

1. A method for triggering an optical protection event in an optical layer of a network comprising the following steps:

- 5      i) monitoring the optical performance of an optical signal transmitted within the optical layer of the network;
- ii) provisioning optical protection in the event the monitored optical performance falls below a first threshold level; and
- iii) triggering an optical protection event, in the event the monitored optical performance falls further to below a second threshold level,

10      wherein the monitoring step is performed within the optical layer of the network by using a proxy to determine an optical performance characteristic which corresponds to the transmission quality of electronic signals extracted from said optical layer signal.

15      2. A method as claimed in claim 1, wherein the optical performance characteristic is derived from the Q value acquired at the source and destination nodes of said optical signal.

20      3. A method as claimed in claim 1, wherein the optical performance characteristic is derived from the Q value acquired between pairs of nodes along the transmission path of said optical signal.

25      4. A method as claimed in claim 1, wherein said first predetermined level of said optical performance is set such that the transmission quality of electronic signals extracted from said optical layer signal is not affected when said level is exceeded.

        5. A method as claimed in claim 1, wherein said second predetermined level of said optical performance is set such that the transmission quality of electronic signals extracted from said optical layer signal is about to be affected when said level is exceeded.

30      6. A method of indicating to network control when degradation in the performance in an optical layer of a communications network has occurred prior to the performance in any higher layers of said communications network being substantially adversely affected, the method comprising the steps of:

i) monitoring the optical performance of an optical signal transmitted within the optical layer of a network using a proxy to determine an optical performance characteristic which corresponds to the transmission quality of electronic signals extracted from said optical layer signal; and

5 ii) generating a first alarm in the event that the optical performance falls below a first predetermined optical performance level to alert the network control of said network that said first predetermined optical performance level has been exceeded.

10 7. A method as claimed in Claim 6, wherein said network control comprises a network operator.

8. A method as claimed in Claim 6, wherein said network control comprises an autonomous network controller.

15 9. A method as claimed in Claim 6, further comprising the steps of  
iii) said network control provisioning optical protection in the event the monitored optical performance falls below the first threshold level.

20 10. A method as claimed in Claim 6, further comprising the steps of  
iv) triggering an optical protection event, in the event the monitored optical performance falls further to below a second threshold level.

25 11. A method as claimed in Claim 6, further comprising the steps of  
iii) said network control provisioning optical protection in the event the monitored optical performance falls below the first threshold level, wherein said optical protection provides end-to-end path protection.

30 12. A method as claimed in Claim 6, further comprising the steps of  
iii) said network control provisioning optical protection in the event the monitored optical performance falls below the first threshold level, wherein said optical protection provides local link protection.

35 13. A protection scheme for a communications network, wherein the optical performance of an optical path in the network is indicated to network control when degradation in the performance in an optical layer of the network has

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occurred prior to the performance in any higher layers of said network being substantially adversely affected, the protection scheme comprising the steps of:

i) monitoring the optical performance of an optical signal transmitted within the optical layer of the network using a proxy to determine an optical performance characteristic which corresponds to the transmission quality of electronic signals extracted from said optical layer signal;

ii) generating a first alarm in the event that the optical performance falls below a first predetermined optical performance level to alert the network control of the network that said first predetermined optical performance level has been exceeded;

iii) the network control provisioning optical protection in the event the monitored optical performance falls below the first threshold level; and

iv) triggering an optical protection event, in the event the monitored optical performance falls further to below a second threshold level.

14. Apparatus for use in a communications network, the apparatus capable of implementing a method of indicating to network control when degradation in the performance in an optical layer of the communications network has occurred prior to the performance in any higher layers of the communications network being substantially adversely affected, the apparatus comprising:

i) a monitor arranged to monitor the optical performance of an optical signal transmitted within the optical layer of a network using a proxy to determine an optical performance characteristic which corresponds to the transmission quality of electronic signals extracted from said optical layer signal; and

ii) an alarm generator arranged to generate a first alarm in the event that the optical performance falls below a first predetermined optical performance level to alert the network control of said network that said first predetermined optical performance level has been exceeded.

15. Apparatus as claimed in claim 14, further comprising:  
provisioning means for said network control to provision optical protection in the event the monitored optical performance falls below the first threshold level.

16. An optical protection system comprising a plurality of apparatus for use in a communications network, each said apparatus capable of implementing a method of indicating to network control when degradation in the performance in an optical layer of the communications network has occurred prior to the performance in any higher layers of the communications network being substantially adversely affected, each said apparatus comprising:-

a monitor arranged to monitor the optical performance of an optical signal transmitted within the optical layer of the network using a proxy to determine an optical performance characteristic which corresponds to the transmission quality of electronic signals extracted from said optical layer signal;

an alarm generator arranged to generate a first alarm in the event that the optical performance falls below a first predetermined optical performance level to alert the network control of the network that said first predetermined optical performance level has been exceeded;

means for said network control to provision optical protection in the event the monitored optical performance falls below the first threshold level;

an alarm generator arranged to generate a second alarm in the event that the optical performance falls below a second predetermined optical performance threshold level, said second alarm triggering an optical protection event.

17. An optical alarm signal indicating that an optical parameter in an optical network has fallen below a first predetermined level, the signal being generated by the performance of a method of indicating to network control when degradation in the performance in an optical layer of a communications network has occurred prior to the performance in any higher layers of said communications network being substantially adversely affected, wherein the method of indicating comprises the steps of:

i) monitoring the optical performance of an optical signal transmitted within the optical layer of a network using a proxy to determine an optical performance characteristic which corresponds to the transmission quality of electronic signals extracted from said optical layer signal; and

ii) generating said alarm in the event that the optical performance falls below a first predetermined optical performance level to alert the network control of said network that said first predetermined optical performance level has been exceeded.

18. An optical alarm signal indicating that an optical parameter in an optical network has fallen below a second predetermined level, the signal being generated by the performance of a method of indicating to network control when degradation in the performance in an optical layer of a communications network has occurred prior to the performance in any higher layers of said communications network being substantially adversely affected, wherein the method of indicating comprises the steps of:

i) monitoring the optical performance of an optical signal transmitted within the optical layer of a network using a proxy to determine an optical performance characteristic which corresponds to the transmission quality of electronic signals extracted from said optical layer signal; and

ii) generating said alarm in the event that the optical performance falls below a predetermined optical performance level to alert the network control of said network that said predetermined optical performance level has been exceeded and to trigger an optical protection event.

19. A method as claimed in Claim 18, wherein said network control first provisions optical protection in the event the monitored optical performance falls below another, first threshold level; and wherein said alarm signal is provided only when said monitored optical performance falls below this first threshold level to below another threshold level.

20. A communications network in which the optical layer is provided with means to implement a method for triggering an optical protection event in an optical layer of a network, the implementation means comprising:

i) a monitor to monitor the optical performance of an optical signal transmitted within the optical layer of the network;

ii) optical protection provisioning means to provision optical protection in the event the monitored optical performance falls below a first threshold level; and

iii) triggering means to trigger an optical protection event, in the event the monitored optical performance falls further to below a second threshold level,

wherein the monitoring is performed within the optical layer of the network by using a proxy to determine an optical performance characteristic which corresponds to the transmission quality of electronic signals extracted from said optical layer signal.

21. A communications network in which the optical layer is provided with means to implement a method of indicating to network control when degradation in the performance in an optical layer of a communications network has occurred prior to the performance in any higher layers of said communications network being substantially adversely affected, the optical layer of the network comprising:

i) an optical performance monitor arranged to monitor the optical performance of an optical signal transmitted within the optical layer of a network using a proxy to determine an optical performance characteristic which corresponds to the transmission quality of electronic signals extracted from said optical layer signal; and

ii) an alarm generator arranged to generate a first alarm in the event that the optical performance falls below a first predetermined optical performance level to alert the network control of said network that said first predetermined optical performance level has been exceeded.

22. A method as claimed in claim 1, wherein the monitoring step is performed whenever a new channel is injected into said optical layer of said communications network.

23. A method as claimed in claim 6, wherein the monitoring step is performed whenever a new channel is injected into said optical layer of said communications network.

24. An indicator for indicating to the network control of a communication network degradation in at least one performance characteristic of any optical layer signal propagating in an optical layer of a communications network, the indication being provided to said network control prior to a performance characteristic in any higher layers of said communications network being substantially adversely affected, the indicator comprising:

an alarm signal triggered in the event that the performance characteristic falls below a predetermined performance level in the optical layer, wherein said predetermined performance characteristic is determined from an optical signal transmitted within the optical layer of a network using a proxy for the transmission quality of electronic signals extracted from said optical layer signal to alert the network control of said network that said predetermined optical performance level has been exceeded and that protection has been provisioned, the alarm being triggered occurred.

25. An indicator as claimed in Claim 24, wherein said protection event comprises the provisioning of a protection channel.

26. An indicator as claimed in Claim 24, wherein said protection event comprises a roll-over of the optical signal to a protection channel.

5 27. An indicator as claimed in Claim 24, wherein the alarm signal comprises a visual alarm on a graphical display device arranged to provide monitor said optical layer network.

10 28. An indicator as claimed in Claim 24, wherein the alarm signal comprises an audio alarm emitted by a suitable device to alert a network operator for said optical layer network.

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